HEATING OR COOLING COLLECTORS

BACKGROUND OF THE INVENTION

[0001] The present invention relates to an apparatus for heating or cooling a fluid medium by means of environmental influences such as light, solar irradiation, radiation, ambient temperature, etc. according to a method of producing such an apparatus, a collector system for obtaining heat and/or for air conditioning and a use of the apparatus or of the system. In particular, films connected to define fluid medium carrying chambers are provided.

[0002] In order to save as much energy as possible during heating or producing hot water and also during the cooling of buildings and swimming baths, use is increasingly being made of roof surfaces and/or facades for the fitting of heating or cooling collectors, be it to generate heat, for example in the form of water or another heat exchange medium heated by solar irradiation, or in order to dissipate heat to the environment for the cooling of the interior of the building.

[0003] As a rule, collectors such as glazed flat or vacuum-tube collectors are used for this purpose, which are arranged on a roof, for example, and in which water or another suitable heat exchange medium is heated by solar irradiation. Then, by means of the heated liquid, in a further liquid circuit, the temperature needed for the heating of the building or for the production of hot water can be set in, for example, a heat pump or a heat exchanger coupled to the collector or collectors. The liquid medium cooled down as a result is then supplied to the collector again for renewed heating of the same.

[0004] In an analogous way, by reversing the temperature gradient, heat in the collectors can be dissipated to the environment in order to air-condition or cool a building.

SUMMARY OF THE INVENTION

[0005] The object of the present invention is to propose a collector by means of which, in a manner analogous to the systems currently known, such as the aforementioned collectors, environmental heat or solar irradiation can be transferred into a fluid medium carried in the collector and which collector is simple to produce, to handle, to install and to operate.

[0006] An apparatus is proposed for heating or cooling a fluid medium by means of environmental influences, such as light, solar irradiation, radiation, ambient temperature, etc., which comprises at least two films which are arranged parallel to each other and which to some extent adhere to one another in such a way that one or more chamber-like cavities or interspaces are formed, which have at least one opening for the supply of a fluid medium and at least one opening for the discharge of the fluid medium.

[0007] According to a preferred design variant, at least two or more chamber-like cavities running virtually parallel beside one another are formed between the films, which are either formed so as to be intrinsically sealed off and each have at least one opening for the supply and discharge of the fluid medium, or else the chamber-like cavities are at least partly interconnected in order to form an at least partly coherent, intrinsically closed cavity system, which has at least one opening for the supply and at least one opening for the discharge of the fluid medium. With this, there is the possibility of connecting the chamber system in such a way that only one feed and discharge is needed for each entire web width.

[0008] The openings for the supply and discharge of the fluid medium are preferably arranged in mutually opposite end regions of the cavities or of the cavity system, in order to guarantee a most extensive aggregate flow through the chamber-like cavities or the cavity system.

[0009] According to a further design variant, one of the two films is connected to a further film, preferably over the entire area, via a nonwoven or a fabric-like reinforcing layer, such as what is known as a supporting layer. The apparatus is then intended to be used simultaneously as a collector and a sealing means.

[0010] The films forming the chambers are preferably fabricated from a polymer material, such as in particular at least predominantly based on a polyolefin. According to a design variant which is preferred as an example, the films are fabricated on the basis of polyethylene having either a fiber reinforcement and/or these films are chemically cross-linked.

[0011] At least that surface of the apparatus which faces the environment is preferably colored black, but can also have another color matched to the environment.

[0012] For the production of the apparatus according to the invention or of the collector according to the invention, a method is proposed in which at least two films are extruded resting on each other by means of fishtail extrusion or laminated. A separating film, a separating nonwoven or fabric, a release agent is introduced or sprayed in between the two film layers in those regions in which the chamber-like cavities are to be the formed, or embossing one film produces an air gap which prevents adhesion in the region of the cavities to be produced.

[0013] According to a further design variant, it is proposed that, after extrusion of the at least two films has been carried out, these films are led together or pressed together in the regions not having a separating film or a separating

nonwoven, a release agent or air gap, in such a way that the two films adhere firmly to each other, after which the films now connected to each other are cooled down.

[0014] After cooling has been carried out, tailoring is carried out in order, finally, to produce the apparatus or the collector.

[0015] Also proposed is a collector system for obtaining heat and/or air-conditioning in a building, which comprises at least one apparatus previously defined or a collector, which is arranged on the roof and/or on the facade of the building and which is connected to a heat pump or a heat exchanger via feed and discharge lines for the transport of a fluid medium, for example for the production of hot water.

[0016] The apparatus or the collector proposed according to the invention, and also the aforementioned collector system, are in particular suitable for the production of hot water and/or the heating of buildings and swimming baths and also for the air-conditioning of a building.

[0017] Other features and advantages of the present invention will become apparent from the following description of the invention which refers to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018] The invention will now be explained in more detail by way of example and with reference to the appended drawings, in which:

[0019] Fig. 1 shows the basic principle of an apparatus or a collector according to the invention in a perspective schematic view;

[0020] Fig. 2 shows a cross-section through the collector of Fig. 1;

[0021] Fig. 3 shows the arrangement of a collector on an existing sealing web, there being a connection between the collector and existing sealing web;

[0022] Fig. 4 shows the lateral marginal termination of the arrangement according to Fig. 3 in cross section;

[0023] Fig. 5 shows the lateral marginal termination of a collector according to the invention combined with a primary seal in cross section;

[0024] Figs 6 and 7 show the mechanical fixing of a collector on a primary seal arranged underneath it in a perspective view, by way of a detail, in cross section;

[0025] Fig. 8 shows a production method for the production of a collector according to the invention by using a flow diagram;

[0026] Fig. 9 shows a possible design variant of a production method schematically by using a perspective illustration, and

[0027] Figs 10 and 11 show in schematic form the arrangement of an apparatus or a collector on a building roof.

DESCRIPTION OF PREFERRED EMBODIMENTS

[0028] The basic principle of an apparatus or a collector according to the invention is illustrated by using the two Figures 1 and 2. In this case, Fig. 1 shows the collector in a perspective view from above and Fig. 2 shows the collector of Fig. 1 in cross section.

[0029] The collector 1 comprises two polymer films 3 and 5 arranged one above the other, which are firmly connected to each other in the marginal regions 7 and in strips 11 formed centrally. Between these fixed connecting regions, chamber-like cavities 9 are formed, which are provided for a fluid medium, such as water, to flow through. The latter is in each case introduced through an inlet opening 13 into a chamber-like cavity 9 in each case and discharged again through an opening 15 arranged at the opposite end of the cavity. At least that film of the apparatus or of the collector 1 which faces the surface is preferably colored black, in order to intercept ambient heat or light or solar irradiation optimally, but the film can also have another color matched to the environment. As a result, the water circulated in the cavity 9 is

heated because of the heating of the collector, so that the outlet temperature TA is higher than the inlet temperature TI. In other words, $\Delta T = TA - TI > 0$.

[0030] It is then possible to arrange a dedicated supply opening 13 and, and correspondingly, a discharge opening 15 for each individual cavity 9. However, it is also possible in each case to interconnect the cavities at the ends, in order to form a single, intrinsically closed cavity system, so that in each case only at least one supply opening and discharge opening have to be provided.

[0031] The two films 3 and 5 connected to each other are preferably comprised of a flexible polymer material, it being important that the polymer chosen is both resistant to hot water and has good UV resistance and chemical resistance. The polymer materials which are at least largely built up from polyolefin have proven to be advantageous, use preferably being made of a material based on polyethylene, which either has a fiber reinforcement and/or has at least partly been chemically cross-linked. Of course, other suitable polymer materials can also be used. It is important, in particular when arranging the collector on a roof, that the polymer material, in addition to the aforementioned hot-water or heat exchange medium and UV resistance, also has good weathering resistance, for example to ozone and resistance to chemicals dissolved in rain, for example, such as in particular to what is known as "acid rain".

[0032] A further design variant of a collector according to the invention is illustrated in Fig. 5, the two films mentioned with reference to Figs 1 and 2 being applied to an additional sealing web 21, for example connected over the entire area to a reinforcing support 23 arranged between them. This reinforcing support 23 can be, for example, a polyester or glass nonwoven and/or a reinforcing fabric, for example in turn based on a polyester material or glass fiber material, or else a carbon fiber material. Arranging on an additional sealing web 21 can be advantageous if the apparatus or the collector according to the invention is arranged directly as a sealing

web, for example on a flat roof. This additional sealing web 21 ensures that the liquid or the water circulating through the cavities 9 cannot get into the interior of the building. By means of the additional supporting layer 23, the covering, including the collector, is given the necessary stability and strength. The 3-layer collector variant illustrated in Fig. 5 can be, for example, a primary seal, so that a further sealing web no longer has to be provided.

[0033] Of course, it is also possible to arrange the apparatus or the collector 1 according to the invention on a sealing web or primary seal 31 which has already been arranged, as illustrated schematically in cross section in Fig. 4 and in perspective in Fig. 3. As can be seen in particular in Fig. 4, the apparatus or the collector is arranged on a primary seal 31 which, in turn, can comprise the two layers 35 and 37, which are connected to each other via a supporting or reinforcing layer 23. The primary seal can in turn be comprised of two or more polymer layers based on a polyolefin or based on any other suitable polymer. Primary seals of this type are known in particular in the sealing of flat roofs or other planes exposed to weathering, such as for the sealing of terraces, garage roofs etc. As can be seen in Fig. 3 and as illustrated schematically in Fig. 4, the collector according to the invention is connected to the primary seal lying underneath by a welded connection 30 produced by means of a welding device or via an adhesively bonded connection.

[0034] Of course, however, it is also possible to connect the collector to the primary seal 31 arranged underneath it mechanically, as illustrated schematically by way of example in cross section in Fig. 7. In the marginal region, the collector 1 is in turn connected to the substrate through the primary seal 31 arranged underneath it by means of a mechanical fixing 39, it being additionally necessary to cover the mechanical fixing by means of a strip 41 which overlaps the fixing and which strip 41 is in turn connected tightly to the collector and to the primary seal 31 by means of welded and/or adhesively bonded joints 43 and 45.

[0035] A production method suitable for the production of the apparatus or the collector according to the invention is illustrated schematically using a flowchart in Fig. 8. The two extruders 55 and 57 are fed from the storage, receiving or charging containers 51 and 53. The components fed from the containers 51 and 53 are, for example, polymer granules or polymer powder and/or additives such as stabilizers, fillers and the like. The extruders 55 and 57 are preferably fishtail extruders, from whose dies the two films are extruded running parallel to each other.

[0036] For the production of the cavities or chambers defined according to the invention, separating materials, such as separating foils, separating films, nonwovens, fabrics or the like are unrolled and introduced between the two films extruded by the fishtail dies. The separating materials can be, for example, aluminum foils, silicone-treated films, etc. Of course, it is also possible, instead of the separating materials listed, to produce the strip-like regions for the production of the cavities, in which regions the two films must not adhere to each other, by spraying in an appropriate liquid release agent. From the region 61, in which the films and the separating means are joined to one another, transport is carried out to rolls 63, where the films are connected firmly in that region where no cavities or chambers are to be formed. The films are then wound up over cooling rolls 65 onto a drum 67.

[0037] As an alternative to the use of separating materials and release agents, it is possible to laminate an embossed film from one roll 91 onto the other films before the cooling rolls 65, for example at the rolls 63. The films are joined firmly to one another at the elevated points of the embossing and the cavities are formed at the depressed points of the embossing.

[0038] From the wind-up 67, the endless films can then be unwound in the desired length and welded at the ends in order to produce the collector according to the invention, in which only the individual hollow chambers still have to be provided

with the supply and discharge openings, through which the liquid flowing through the cavities can be supplied and discharged.

[0039] One possible design variant of the production method is to be explained in more detail using Fig. 9. On the drum 59 containing the separating material according to Fig. 8, there can be arranged, for example, a supporting material as illustrated in Fig. 9, which is for example a nonwoven-type or fabric-type material. This supporting nonwoven or fabric is additionally treated with a separating material along strip sections 71, so that during the extrusion in the region 63, again based on Fig. 8, no connection can be produced between the upper and lower films, while in the remaining regions 73 of the supporting nonwoven or fabric, penetration by the liquid polymer material is possible because of the lack of separating means. Based on Fig. 9, this now means that an apparatus or a collector 1 having the desired cavities 9 in the regions 71 has been formed, that is to say in this region the two polymer films do not adhere to each other. By contrast, in the regions 73 there is a firm connection between the two polymer films covering the collector at the top and bottom.

[0040] It is thus possible, as the supporting nonwoven or fabric is wound up onto the drum 59, to apply a separating means to the supporting material in the regions 71 in accordance with the collector lengths to be produced, by which means, during the production of the collectors according to the invention, the required cavities are then produced.

[0041] The two Figs 10 and 11 illustrate one possible way of arranging an apparatus or a collector according to the invention in each case on a house roof. In Fig. 10, a collector 1 according to the invention is arranged on a flat roof and, as required according to the invention, has the cavities or chambers arranged longitudinally parallel beside one another. The individual chambers are fed via inlet openings 13, which are interconnected via a connecting line 14, which is fed with

water, for example, at one end via an opening 85. On the opposite side, the carrier liquid or the water leaves the cavities 9 via openings 15, which are in turn interconnected via a connecting line 16, from which connecting line the carrier liquid leaves the collector via an opening 87. The feed line 85 and the drain 87 are preferably arranged diagonally opposite one another, in order to permit an optimum, uniform flow through the individual hollow chambers 9.

[0042] In an analogous way, in Fig. 11 a collector 1 is again arranged on an inclined roof, is in turn fed through an inlet opening 85 and emptied via an outlet 87.

[0043] Analogous to the production of heat or hot water, it is of course also possible, conversely, to use the collector 1 for the air-conditioning or for the cooling of a building. In this case, the carrier medium gives up heat to the environment via the collector 1.

[0044] It is, of course, therefore expedient to equip the collector with a light color or to keep it away from the action of solar irradiation, in order that no heat is absorbed by the collector.

[0045] The apparatuses or collectors and applications according to the invention illustrated with reference to Figs 1 - 11 are of course only examples which can be changed, supplemented or modified in any desired manner. For example, it is of course possible to form the chambers between the two films in another way to that illustrated in Fig. 1 and the following ones, that is to say, for example, it is possible for large-area cavities to be formed or else extremely small chambers which more resemble a pipe matrix. In addition, the polymer materials used are of course not restricted to those based on polyethylene, instead any other polymer materials can be used, such as polypropylene, polybutene, cross-linked EPDM (terpolymer based on ethylene, propylene and diene monomers) which have the necessary hot-water resistance, UV and weathering resistance and chemical resistance.

[0046] In addition, the arrangement of the collectors according to the invention is not restricted to fitting to a roof surface, instead collectors of this type can be arranged on any flat substrates, such as terraces, garage roofs, facades and the like.

[0047] Although the present invention has been described in relation to particular embodiments thereof, many other variations and modifications and other uses will become apparent to those skilled in the art. It is preferred, therefore, that the present invention be limited not by the specific disclosure herein, but only by the appended claims.